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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/578,390	05/05/2006	Im Young Jung	CU-4805 WWP	1845
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EXAMINER				
GIARDINO JR, MARK A				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/578,390

**Applicant(s)**

JUNG ET AL.

**Examiner**

MARK A. GIARDINO JR

**Art Unit**

2185

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 12 March 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-13 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SF/ICE)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

The Examiner acknowledges the applicant's submission of the amendment dated 3/12/2009. At this point claims 1, 10, and 13 have been amended. Thus, claims 1-13 are pending in the instant application.

The instant application having Application No. 10/578,390 has a total of 13 claims pending in the application, there are 3 independent claims and 10 dependent claims, all of which are ready for examination by the examiner.

**REJECTIONS NOT BASED ON PRIOR ART**

**Claim Rejections - 35 USC ' 112**

**The following is a quotation of the second paragraph of 35 U.S.C. 112:**

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-13 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 contains the limitation "performing a sweep phase during the communication cycle until deleting all the listed objects", yet the last section of the claim contains the conditional "if objects to be deleted remain after performing the mark phase and the sweep phase during the communication cycle". Therefore, it is unclear if all listed objects are deleted during the communication cycle. Claims 10 and 13 have state similar limitations. Appropriate correction is required.

Claim 1 contains the limitation that during the sweep phase, "calculating a residual time according to the first list of objects to be deleted", and also "updating the first list of objects" are performed. The last limitation of the claim recites "the sweep phase is performed during the other communication cycles". Thus, the residual time is recalculated as this is in the sweep phase. It is unclear if, during subsequent sweep phases, this is done "according to the first list of objects to be deleted" or if the updated first list is used. Appropriate correction is required.

#### **REJECTIONS BASED ON PRIOR ART**

##### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 1-4, 6, 10, and 13 are rejected** under 35 U.S.C. 103(a) as being unpatentable over **Engelstad et al (US 5,485,613) in view of Hasbun (US 5,640,529)**.

**Regarding Claim 1**, Hasbun teaches a garbage data collection method performed during a communication cycle of a plurality of communication cycles of a computing device **(the communication cycle corresponding to the command and the timed command interrupt, Column 2 Lines 19-24 in Hasbun)** having memory including writeable non-volatile memory **("solid state disk", Column 2 Line 25 in Hasbun)**, the garbage data method comprising:

calculating a residual time according to the first list of objects to be deleted up to a predetermined time limit after processing an external command (**Figure 8 in Hasbun, also Column 2 Lines 19-27, and this is done according to a list of objects to be deleted, since the number of CSM states to execute [step 420 of Figure 8] is determined based on the amount of memory that must be cleaned up, step 416 and Column 12 Line 64 to Column 13 Line 7).**

However, Hasbun doesn't specifically teach performing mark and sweep phases during communication cycles or making a first list of objects to be deleted. Engelstad teaches performing a mark phase during a communication cycle, the mark phase for making a first list of objects to be deleted from a memory (**the first list corresponds to unmarked objects in the condemned region, since the objects being unmarked means they are to be deleted from memory, Column 27 Lines 9-16 in Engelstad**);

performing a sweep phase during the communication cycle until deleting all the listed objects of the first list from memory (**this phase corresponding to when "the object is removed from the generation and memory resources associated with the object are freed", Column 27 Lines 14-16 in Engelstad**), wherein the performing of the sweep phase comprises:

deleting the listed objects of the first list from the memory within a predetermined time (**"the object is removed from the generation and memory resources associated with the object are freed", Column 27 Lines 14-16, this is done within the predetermined time since this is done during garbage collection, and garbage**

**collection must be done within a predetermined time as in Column 12 Lines 26-27), and**

updating the first list of objects to list those undeleted objects of the first list which remain after the lapse of the calculated residual time **(the list is updated because the freed object is removed from the generation [Column 27 Lines 14-16] and thus not scanned again, so the unmarked objects in the condemned region [the first list] is updated by removing these objects from the generation)**, and storing the updated first list in the memory **(the unmarked objects remain in the generation of objects to be deleted, also see Figure 4 of how after each task the garbage collector may be exited and completed later [step 412] and how freeing an object is listed as a task, Column 27 Line 22),**

and wherein, if objects to be deleted remain after performing the mark phase and the sweep phase during the communication cycle, only the sweep phase is performed during the other communication cycles **(the unmarked objects remain in the generation of objects to be deleted, also see Figure 4 of how after each task the garbage collector may be exited and completed later [step 412] and how freeing an object is listed as a task, Column 27 Line 22, thus the sweep phase is performed during subsequent communication cycles).**

It would have been obvious to a person having ordinary skill in the art at the time the invention was made to which the subject matter pertains to have implemented the garbage collection of Engelstad as the method of Figure 7 in Hasbun because the method of Engelstad can complete in a predetermined period of real time, making it

useful in real-time object-oriented program-controlled systems (Column 4 Lines 27-42 in Engelstad).

**Regarding Claim 2**, Engelstad and Hasbun teach all limitations of Claim 1, wherein the time limit is determined by a host that transmits the external command or the time limit is determined to be a period of time up to a time guaranteeing QoS that a user does not feel a response delay to the external command (Column 12 Line 24-25 in Engelstad, where the cycle bound is 10 ms, a small enough amount that user would not feel a response delay).

**Regarding Claim 3**, Engelstad and Hasbun teach all limitations of Claim 1, wherein the act of making the first list is performed when a garbage collection is requested (the list is made during steps 1 through 7 of Column 13 Lines 33-41, and when these commands are entered [as in the "YES" branch of step 408 of Figure 4], garbage collection is requested by the processor).

**Regarding Claim 4**, Engelstad and Hasbun teach the limitations of Claim 1 As described above, and Engelstad's garbage collection process further comprises adding to the first list any object earmarked for deletion in a prior communication cycle but remaining in the memory undeleted (phase 2 in Figure 5A of Engelstad, where older generations [objects earmarked for deletion in a prior communication cycle] are repacked into and entered into the condemned region, Column 14 Lines 17-41 in Engelstad).

**Regarding Claim 6**, Engelstad and Hasbun teach all limitations of Claim 1, wherein the act of deleting the objects of the first list comprises: making a second list of

objects to be deleted from the memory during any residual time remaining after all objects in the first list (the garbage collection process will move on from step 8 in Column 13 Line 41 to step 1 in Column 13 Line 33, which is the beginning of making a second list with a new condemned region).

**Claim 10** is the apparatus analogous to the method of Claim 1, and is rejected under similar rationale.

**Claim 13** is the computer readable medium recorded thereon a computer readable program analogous to the method of Claim 1, and is rejected under similar rationale.

Claims 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engelstad and Hasbun in further view of Serlet (US 5,355,483).

**Regarding Claim 5**, Engelstad and Hasbun teach all limitations of Claim 1, but do not teach updating the list when an object is newly generated or deleted. Serlet teaches if an object is newly generated or deleted during the command processing, updating the list of objects to be deleted (note that when garbage collection begins, the state machine described in Figure 7 of Serlet will make the list, and since the command is run as part of the garbage collection process of Engelstad, the list of objects to be deleted is updated when the command newly generates or deletes an object). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to which the subject matter pertains to have used the method of garbage collection in Figure 7 of Serlet instead of the way described by Engelstad, since using Serlet's method enables garbage collection to be "performed automatically without



requiring that the ongoing processing steps of the user processor be halted during the garbage collection process" (Column 6 Lines 32-35 in Serlet).

Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Engelstad and Hasbun in view of Kolodner et al (US 2002/0055941).

**Regarding Claim 7**, Engelstad and Hasbun teach all limitations of Claim 1, however, the combination of references do not teach deleting an undeleted list of objects of a prior communication cycle before a command is processed.

Kolodner et al (US 2002/0055941) teaches collecting garbage before processing a command if the next command may be pressed for space (Paragraph 0138 in Kolodner). It would have been obvious to a person having ordinary skill in the art at the time the invention was made to which the subject matter pertains to have implemented the preemptive garbage collection before processing external commands to ensure that the external command to be processed does not have to be interrupted to perform garbage collection (Paragraph 0138 in Kolodner).

Claims 8, 9, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Engelstad and Hasbun in view of Wells et al (US 5,740,395).

**Regarding Claim 8**, Engelstad and Hasbun teaches all limitations of Claim 1 as discussed above. However, Engelstad and Hasbun do not teach performing together a memory write command and object delete command. Wells teaches if the command includes a memory write command or an object delete command (the command is a

memory write, see Column 19 Lines 21-23 and Figures 12A and 12B in Wells), and if there is a list of objects to be deleted from the memory before the write or delete command is processed, concurrently performing the deleting of the objects and the write or delete command (Column 19 Lines 43-51 in Wells). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to which the subject matter pertains to have performed the memory write command with the object delete command since this allows the device to maintain minimum memory reserves (Column 19 Lines 43-46 in Wells). Thus, by combining the devices, the additional benefit of maintaining memory reserves necessary for proper performance is obtained.

**Regarding Claim 9**, Engelstad and Hasbun teach all limitations of Claim 1 as discussed above. However, Engelstad and Hasbun do not teach simultaneously deleting consecutively existing objects in memory, nor does he teach concurrently performing the allocating and deleting of a memory block if memory space to be allocated for an object and memory space of objects to be deleted are consecutive memory spaces or the same memory space. Wells teaches simultaneously deleting consecutively existing objects in memory (note how blocks are cleaned up in their entirety, thus the sectors consecutively existing in memory are cleaned up simultaneously, see Column 21 Lines 50-55 in Wells). Wells also teaches allocating and deleting a memory block concurrently (Column 21 Lines 50-67 in Wells, note how the block is freed and a new block is selected, and that this new block is likely to be the block that was just freed since the criteria for choosing a block from the 5 Rules for choosing a block described by Wells have not changed substantially). It would have

been obvious to a person of ordinary skill in the art at the time the invention was made to which the subject matter pertains to have used these teachings of simultaneously deleting consecutive objects in consecutive memory space and simultaneously deleting a memory space and allocating the memory space because doing so is much faster than not performing the actions concurrently. Thus, by combining the devices, one of ordinary skill in the art would realize that the benefit of a faster device is obtained.

**Claim 11** is the apparatus analogous to the method of Claim 7, and is rejected under similar rationale.

**Claim 12** is the apparatus according to the method of Claim 8, and is rejected under similar rationale.

## **ARGUMENTS CONCERNING PRIOR ART REJECTIONS**

### **Rejections - USC 102/103**

Applicant's arguments with respect to claim 1 that Hasbun does not teach the separation of mark and sweep phases has been considered, but is moot as Hasbun is not used to teach this newly added limitation.

Applicant's argument with respect to claim 1 that Hasbun does not teach "calculating a residual time" has been considered but is not persuasive. Figure 8 in Hasbun teaches executing a host command (step 406) and subsequently running clean-up if there is enough time, that is, if there is enough residual time left after the executed command. Therefore, a residual time is calculated. Further, this is done according to a list of objects to be deleted, since the number of CSM states to execute (step 420 of

Figure 8) is determined based on the amount of memory that must be cleaned up (step 416 and Column 12 Line 64 to Column 13 Line 7).

Applicant's arguments on Pages 13-14 of the submitted remarks that regarding the triggers of Hasbun and that Hasbun does not guarantee a response time has been considered, but do not concern limitations in the claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's argument that Engelstad does not teach garbage collection in memory, but rather in object oriented systems, has been considered but is not persuasive. The method of garbage collection taught by Engelstad most broadly applies to a "digital data processing system", including a computer, and thus may be used for applications such as that in the instant application.

Applicant's argument that Engelstad focuses on a condemned region and not all objects of a memory space has been considered, but the language of scanning the entire memory is not in the claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's argument with respect to claim 1 that Engelstad does not teach a list has been considered but is not persuasive, as the collection of objects to be deleted may reasonably be construed as a list.

Applicant's argument that the residual time calculation would be pointless in the device of Engelstad has been considered but is not persuasive. The added limitation

regarding the residual time ('according to the first list of objects to be deleted") has been construed to mean based on the size of the list of objects to be deleted, and if there aren't enough objects to be deleted, the residual time is shortened (as in step 416 of Figure 8 of Hasbun, where the process is exited if there is not enough objects to be collected). In the combination of Hasbun and Engelstad, the collection process (including the marking and sweeping of objects) of Engelstad is performed during the calculated time of Hasbun, and is not redundant.

Applicant's argument on Page 17 that Engelstad does not perform garbage collection when called on and does not teach that once an item is to be deleted it is immediately added to the deletion list has been considered but is not persuasive. These limitations are not mentioned in the claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's argument on Pages 17-18 of the submitted remarks that Engelstad cannot be performed over multiple communication cycles because a task is an indivisible portion of the garbage collector's work and must complete within one cycle has been considered but is not persuasive. Even though a task is indivisible and must be completed within one cycle, the specific phases (including phase 3, which includes marking, Column 14 Lines 33-38, and the garbage reclamation (which includes the 'sweep' phase in Phase 8) are both in separate phases, which itself is broken into separate tasks (Column 13 Lines 42-44 in Engelstad). Therefore, since the mark and sweep phases in Engelstad are in different phases, each broken down into tasks, the

mark and sweep phases can be performed separately and in different communication cycles.

## **CLOSING COMMENTS**

### **Conclusion**

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

## **STATUS OF CLAIMS IN THE APPLICATION**

The following is a summary of the treatment and status of all claims in the application as recommended by **M.P.E.P. ' 707.07(i)**:

**CLAIMS REJECTED IN THE APPLICATION**

Per the instant office action, claims 1-13 have received a second action on the merits and are subject of a second action final.

**DIRECTION OF FUTURE CORRESPONDENCES**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to M. Anthony Giardino whose telephone number is (571) 270-3565 and can normally be reached on Monday - Thursday 7:30am - 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Sanjiv Shah can be reached on (571) 272 - 4098. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

M.A. Giardino  
/M.G./  
Patent Examiner

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Primary Examiner, Art Unit 2185

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June 9, 2009